

Name: Nwadike Peace Ulloma

Course: CHEMISTRY 102

MATRIC NO: 19/AMB01/262

DEPT: MEDICINE AND SURGERY.

1) Give the IUPAC names of the following compounds

Answer

- (a)  $\text{HCOOH}$   $\rightarrow$  Methanoic acid  
(b)  $\text{HOOCCH}_2\text{CH}_2\text{CH}_2\text{COOH}$   $\rightarrow$  Pentan-1,5-dioic acid.  
(c)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$   $\rightarrow$  Butanoic acid  
(d)  $\text{HO}_2\text{C}-\text{CO}_2\text{H}$   $\rightarrow$  Ethanedioic acid  
(e)  $\text{CH}_3(\text{CH}_2)_4\text{COOH}$   $\rightarrow$  Hexanoic acid  
(f)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$   $\rightarrow$  Hex-1-enoic acid.

2) Discuss Briefly the physical properties of carboxylic acids under the following headings:

i. PHYSICAL APPEARANCE:

All simple aliphatic carboxylic acids up to  $\text{C}_{10}$  are liquids at room temperature. Most other carboxylic acids are solids at room temperature although anhydrous carboxylic acid (acetic acid) also known as glacial ethanoic acid freezes to an ice-like solid below the room temperature.

ii BOILING POINTS:

Boiling Points increases with increasing relative molecular mass. Aromatic carboxylic acids are crystalline solids and have higher melting points than their aliphatic counterparts of comparable relative molecular mass.

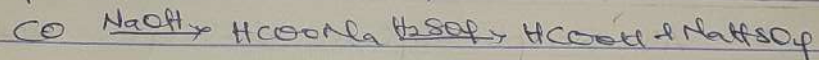
### iii Solubility.

Lower molecular mass carboxylic acid with up to four carbon atoms in their molecules are soluble in water, this is largely due to their ability to form hydrogen bonds with water molecules. The water solubility of these acids decreases as the relative molecular mass increases because the structure becomes relatively more hydrocarbon in nature and hence covalent. All carboxylic acids are soluble in organic solvents.

### 3 Write two industrial preparations of Carboxylic acids

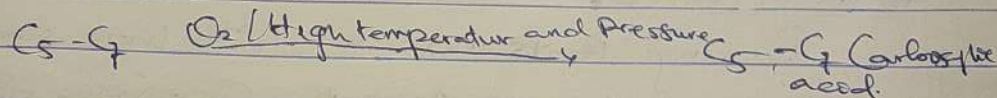
#### (i) From Carbon (II) oxide

Methanoic acid (formic acid) is manufactured by adding Carbon (II) oxide under pressure to an aqueous solution of sodium hydroxide. The free carboxylic acid is liberated by careful reaction with tetraoxosulphate (VI) acid  $H_2SO_4$ .



#### ii) From Petroleum

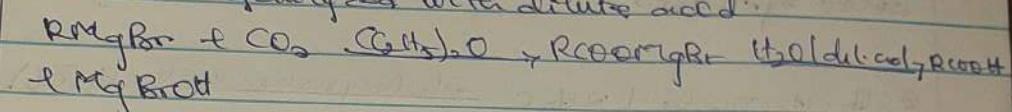
Liquid phase air oxidation of  $C_5 - C_9$  alkanes obtainable from petroleum at high temperature and pressure will give  $C_5 - C_9$  carboxylic acids with methanoic, propanoic and butanedioic acid as by-products.



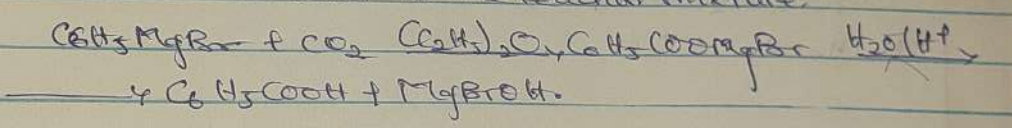
### (4) With equations and brief explanation discuss the synthetic preparation of carboxylic acid.

1) Oxidation of Primary alcohols and aldehydes  
 Oxidation of Primary alcohols and aldehydes can be used to prepare carboxylic acids using the usual oxidizing agents (i.e.  $K_2Cr_2O_7$  or  $KMnO_4$  in acidic solution).  
 $RCH_2OH \xrightarrow{[O]}$  excess acid /  $KMnO_4$ ,  $RCHO \xrightarrow{[O]}$   $RCOOH$

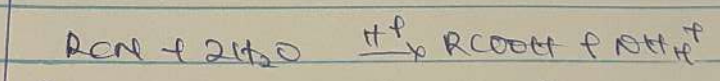
ii) Carbonation of Grignard reagent:  
 Aliphatic carboxylic acids are obtained by bubbling carbon(IV)oxide into the Grignard reagent and then hydrolyzed with dilute acid.



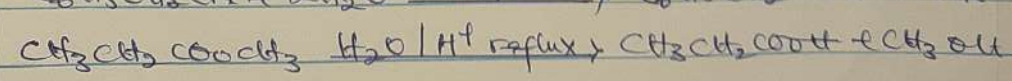
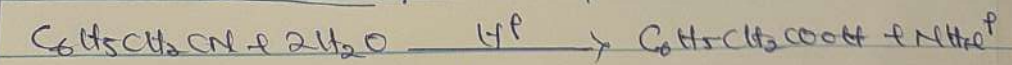
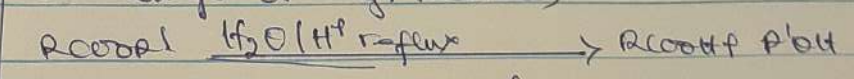
R may be  $1^\circ, 2^\circ, 3^\circ$  aliphatic alkyl or aryl radical  
 In the preparation of benzoic acid, the reagent is added to solid carbon(IV)oxide (dry ice) which also serves as coolant to the reaction mixture.



iii) Hydrolysis of nitriles (cyanides) or esters



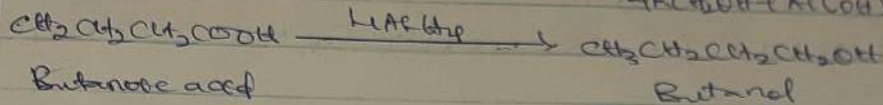
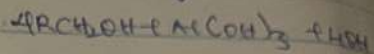
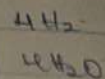
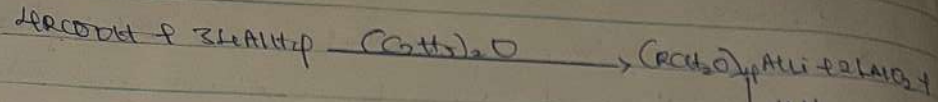
CR = alkyl or aryl radical



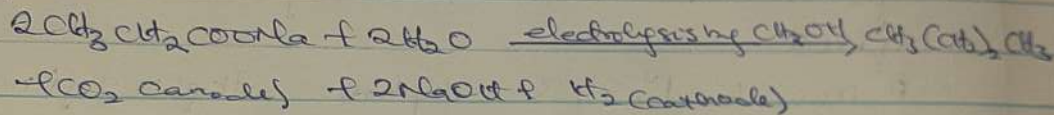
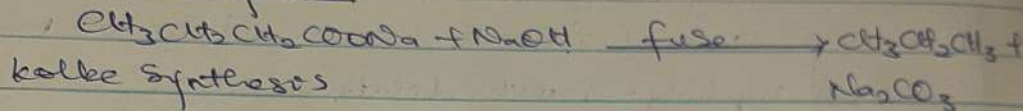
5) Write chemical equation only, Outline the mechanism of carboxylation and esterification of carboxylic acid.

Answer

Reduction



(i) Decarboxylation:



(ii) Esterification:

